

### **REMARKS**

The interview granted applicant's attorney on April 20, 2005 is appreciated. At the interview the advantages derived from applicant's invention as set forth in the claims and the differences between it and the prior art were discussed. Moreover, it was agreed that main claim 8 would be further amended to clarify the function of the maleic anhydride or maleic acid in the furfuryl alcohol monomer solution. While no agreement was reached on allowable claims, the Examiner did agree to reconsider his rejection of the claims as set forth in the Office Action of December 7, 2004.

More specifically, main claim 8 has been amended to recite that the maleic anhydride or maleic acid in the solution impregnated into the wood is a polymerization initiator for the polymerization of the furfuryl alcohol. Support for this can be found, for example, on page 3, lines 6-10 or page 5, line 24. Claim 8 has also been amended to make it clear that the initiator can also be a combination of the maleic anhydride or maleic acid. See page 2, line 35 or page 3, line 10.

As discussed at the interview, impregnating wood with a furfuryl alcohol solution and polymerizing it in the wood to produce a useful furan polymer impregnated wood is the starting point of this invention and is disclosed, for example in WO 02/30638, published April 18, 2002. Typically the wood is impregnated with an undiluted polymerizable solution of furfuryl alcohol, and a chemical initiator. While treatment with this solution resulted in retention values of the furan polymer formed of up to 200% of the weight of the dry wood for soft woods and up to 100% for hard woods, the disadvantage with this treatment was the large amounts of chemical used and the resulting cost. Furfuryl alcohol is water soluble and easily forms a uniform solution with water. See page 1, lines 34-35 of the specification. Thus applicant considered using an

aqueous impregnating solution of furfuryl alcohol instead to reduce costs. However, furfuryl alcohol that has been initiated with a chemical initiator to make it polymerize does not mix well with water, resulting in a solution that separates. Consequently, the wood is not impregnated uniformly with the polymer. See page 2, lines 3-8 of the specification.

Applicant found, however, that by including borax in the impregnating solution, a more uniform solution could be formed, resulting in a more uniform distribution of furan polymer in the wood and a wood product of more uniform color and density. Typical treating solutions for use in the present invention are set forth in Table 2 on page 6 of the specification. They are aqueous solutions of furfuryl alcohol, maleic anhydride as the polymerization initiator and borax. Note from these tables and as now set forth in main claim 8, the resulting impregnated wood has a furan polymer content of from 6.3 to 48.3%.

While the content of polymer in the impregnated wood is less than when an undiluted solution of furfuryl alcohol is used (see Table 1 - "Initiated FA" which contained 93.9% of furfuryl alcohol (FA) and 6.5% of maleic anhydride (MA) as an initiator, but no water or borax), the percentage of polymer uptake was higher than would have been expected based on the amount of furfuryl alcohol present. Note, for example, with an aqueous impregnating solution containing only 33.3% of FA the percentage increase in wood weight for pine was 30.9%, whereas with an undiluted solution containing 93.9% of FA (nearly three times more FA), the percentage increase in wood weight for pine was 57.4%, or slightly less than twice as much. Moreover the % ASE (anti-swell efficiency) was only 30% better for the undiluted treating solution

compared to the diluted one, i.e., 58 versus 44 for pine. This is further exemplified in Table 3.

Thus applicant has achieved with the method of this invention an improved furan polymer impregnated wood product at a lower cost.

In the Office Action of December 7, 2004, the Examiner continued to reject claims 8 and 10-12 under 35 U.S.C. §103(a) for being obvious over U.S. Patent No. 4,678,715 to Giebeler et al. (hereafter Giebeler) in view of U.S. Patent No. 5,804,591 to Valcke et al. (hereafter Valcke) and EP 1069173 (hereafter EP'173).

The primary reference to Giebeler discloses a process for treating wood with monomeric reactive compounds of thermosetting polymers. Reactive components contemplated may include, *inter alia*, maleic acid or anhydride (column 3, lines 6 and 7) and furfuryl alcohol (column 3, line 67). The reactive components can be introduced into the wood as a solution in water (column 3, lines 17-19).

First of all, as noted in the last Reply, there is no teaching in Giebeler that the furfuryl alcohol and the maleic acid or anhydride can be used together as the reactive components. The Examiner argues in the above Office Action, that since Giebeler refers to these both as reactive components, that it "teaches a process wherein furfuryl alcohol is present with maleic anhydride or maleic acid."

However, this is not a correct reading of Giebeler. In column 3, lines 3-7, Giebeler teaches that "maleic acid or anhydride "can be used as "polymerizable monomeric substances capable of reacting with wood constituents." Emphasis added. Then in column 3, lines 8-11, it teaches that "other" reactive components include "furfuryl alcohol," but that when it is used, "an aldehyde or ketone" is required as "a

coreactant.” Thus Giebeler teaches that furfuryl alcohol and an aldehyde or ketone can be reacted together, but there is no teaching that maleic acid or anhydride, which is not an “aldehyde or a ketone,” can be reacted or used with furfuryl alcohol. On the contrary, when maleic acid or anhydride is used, it is used alone as “a polymerizable monomeric substance.” Column 3, line 3 of Giebeler. This is consistent with the rest of the teachings of Giebeler which note that the preferred reactive components are “phenol and formaldehyde” (column 3, line 42) or furfuryl alcohol or phenolic components and formaldehyde (column 3, line 66 to column 4, line 1). Furfuryl alcohol is never used with maleic acid or anhydride, nor is there any suggestion in Giebeler that it should. The only substances suggested to be coreacted or used with furfuryl alcohol are “an aldehyde or ketone.” While this may form “a furan polymer,” it is not the furan polymer of the claims.

Moreover, the maleic anhydride, maleic acid or a combination thereof is not used in the impregnating solution of claim 8 as a “coreactant” in the sense intended by Giebeler, but rather as an initiator for the polymerization of the furfuryl alcohol monomer.

Thus it is submitted that contrary to the Examiner’s comments, Giebeler does not teach a process for impregnating wood where “furfuryl alcohol is present with maleic anhydride or maleic acid.”

Secondly, as noted by the Examiner, Giebeler does not teach anything about the presence of borax in the solution as required by applicant’s claims. As discussed above and as demonstrated in the specification, it is the presence of this stabilizer that enables the furfuryl alcohol monomer, initiated by maleic anhydride or maleic acid, to be

used in an aqueous solution which results in a more uniform distribution of initiated monomer in the solution used to treat the wood and a furan polymer impregnated wood product having uniform color and density. See page 2, lines 15-17 and page 3, lines 2-6 of the specification.

The secondary references to Valcke and EP'173 may show solutions for treating wood containing borax. However, none of the solutions have anything to do with any polymerizable solutions for impregnating wood, let alone a polymerizable furfuryl alcohol monomer solution, to obtain a polymer impregnated wood product. Valcke relates to a fungicidal composition and EP'173 to an anti-inflammatory composition. More importantly, none of these references teach or even remotely suggest that the use of borax will make chemically initiated furfuryl alcohol monomer more uniformly soluble in water.

The references may have to do with preserving wood and the wood product produced by the method of this invention is chemically preserved wood, but that is the only similarity between the references and the invention. The borax is not used in this invention to preserve the wood per se, but to enable the furfuryl alcohol monomer to more efficiently and effectively polymerize and form a furan polymer impregnated wood product. There is no suggestion whatsoever in either of the secondary references that borax could be used as a stabilizer in an aqueous solution of furfuryl alcohol and maleic anhydride or maleic acid or a combination thereof as a polymerization initiator to provide a more uniform furan polymer impregnated wood product. Applicant's invention overcame a problem caused by the water insolubility of initiated furfuryl alcohol

monomer by including borax in the mix and there is absolutely nothing in these references that would suggest applicant's solution to this problem.

As noted previously, the case law requires that to combine references to support an obvious rejection, the prior art references must suggest the desirability of making the claimed combination, not applicant's specification.

Where is the "desirability" suggested in the secondary references of making the substitution suggested by the Examiner? There is nothing in these references that would suggest the result achieved by applicant's invention. As noted by the court in in re Dow Chemical Co., 837 F.2d 469, 5 U.S.P.Q. 2d 1529 (Fed. Cir. 1988) "both the suggestion of the invention and the expectation of its success must be found in the prior art" (emphasis added). See also M.P.E.P. § 716.02(a).

As noted in the last Reply, Giebeler teaches that "small amounts of reactive components" of thermosetting polymers are introduced into the wood (see abstract) or column 2, lines 44 and 45 resulting in polymer percentages of only "0.1 to 2.5 weight percent, relative to the dry weight of the wood" (see column 1, lines 64-65). This is because, as explained in column 1, lines 5-7, the polymer is used to preserve the wood's "dimensional stability and its resonant properties." In contrast, applicant retains much greater quantities of the furan polymer (i.e., 6.3 to 48.3% as set forth in claim 8) to chemically protect the wood from biodeterioration.

Accordingly, for all of the foregoing reasons, it is believed claims 8 and 10-12 are in condition for allowance.

In an Information Disclosure Statement filed simultaneously herewith the Examiner's attention was drawn to five U.S. patent documents cited in a copending

application of applicant. Particular reference was drawn to Example 62 of the Hess '995 document.

In Example 62 of this reference wood is impregnated with a mixture of furfuryl alcohol (95 parts-weight) and a "delayed latent catalyst (5 parts)." While the catalyst in the Example is a mixture of  $\alpha$ -trichlorotoluene and pyridine, according to column 8, line 60 of Hess '995, maleic anhydride is apparently a suitable alternative.

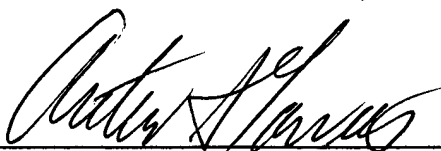
What is significant here is that there is no water present. Note that the mixture of Example 62 is 95 parts furfuryl alcohol and five parts catalyst. Not only does this equal 100 parts, no water is mentioned as being present. This is representative of the type of polymerizable furfuryl alcohol solution applicant was seeking to improve by using it in an aqueous solution.

In view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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